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ABSTRACT

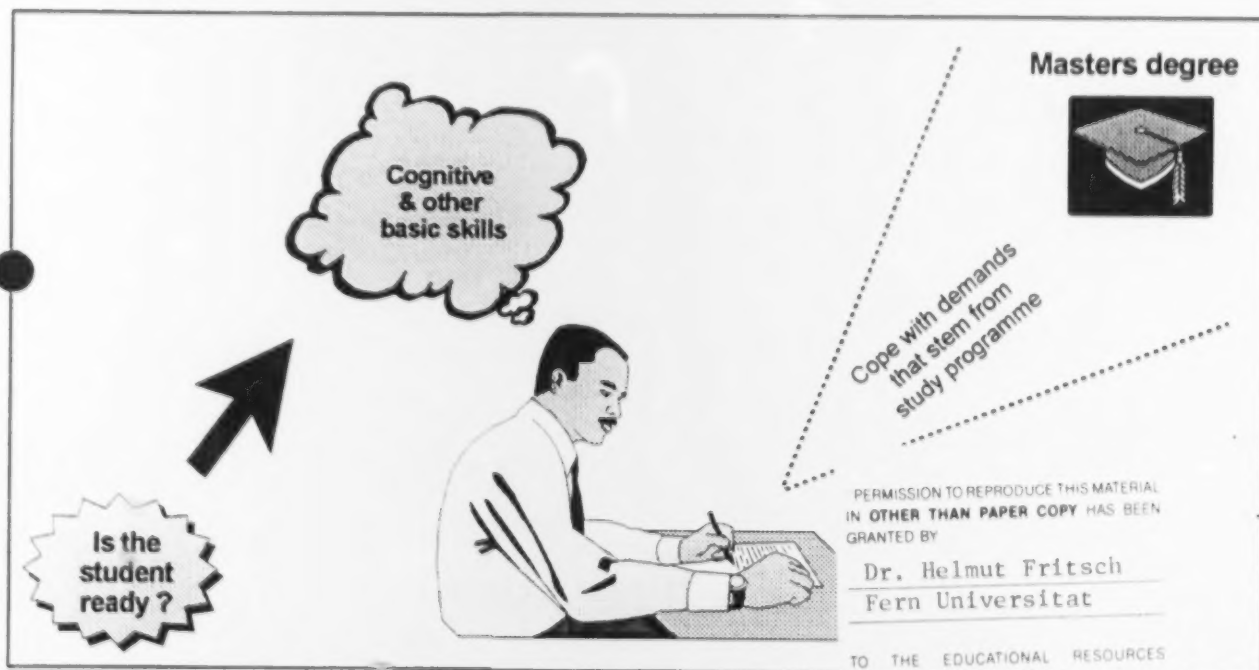
In response to the difficulties of many masters degree students, this on-going project aimed, first, to identify cognitive and metacognitive skills needed for masters level study; second, to develop an instrument to determine students' readiness for masters level work; and, third, to design bridge courses to prepare prospective students. An investigation into the required skills determined that these included cognitive and metacognitive operations. Cognitive operations were defined as those that produce meaning, and metacognitive operations as those that direct or control how that meaning is produced. In developing an instrument for assessing student readiness the project is identifying key words and phrases which could prompt students to use different cognitive skills. The project will then formulate examples of questions at various cognitive levels to try to clarify the differences between the intent of questions at various cognitive levels. A final step will be to formulate examples of questions at various cognitive levels in terms of a short text selection with a view to contextualizing the phrases developed in the second step. Three tables set out examples of cognitive and metacognitive skills and examples of questions for the instrument with explanation of their intent. (Contains 16 references.) (JB)

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● Linda Niehaus

The readiness of prospective masters degree students in terms of cognitive and other basic skills



Zentrales Institut für Fernstudienforschung
FernUniversität - Gesamthochschule -
Hagen, Sept. 1995

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ABSTRACT

Many masters degree students are often not completely successful in their studies. Some fail to gain the masters degree, others take inordinately long to do so. There are probably several ways to deal with this problem. This investigation is focussed on improving the quality of prospective masters degree students' thinking by improving, through instruction, specific cognitive (thinking) skills, as well as other relevant basic skills which are necessary to undertake the masters degree study programme. By means of the research undertaken, clarity will be sought on the readiness of prospective masters degree students; viz. classifying the students in terms of cognitive and other relevant basic skills which are necessary to undertake a masters degree programme. Based on information obtained in this regard, educational practices could be aimed at preparing students, where necessary, to cope with the demands that stem from the masters degree study programme. Such an approach could lead to expanding academical excellence through the masters degree study programme and to maintaining academic standards to ensure the value and credibility of the masters degrees.

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THE READINESS OF PROSPECTIVE MASTERS DEGREE STUDENTS IN TERMS OF COGNITIVE AND OTHER BASIC SKILLS

The purpose of this lecture is to present a review of a research project on prospective masters degree students' readiness, in terms of cognitive and other basic skills, to undertake the masters degree study programme.

1. INTRODUCTION

How could academic and other standards be maintained, whilst at the same time expanding educational excellence and improving the cost-effectiveness of the higher education system within the South African context? How should the higher education system be funded? What mechanisms should be put in place to ensure that funds from state resources intended for the realisation of national higher education policies and for reconstruction are optimally utilised thereto? These questions reflect some of the crucial and challenging issues which are currently being addressed in endeavours to provide a well-planned, integrated, high quality system of higher education for South Africa. The White Paper on Education and Training (1995:32-33) and the policy document of the African National Congress (1994:376-379) point out that the higher education system as a whole has to deal with the effects of rapid enrolment growth and the simultaneous decline in the real value of subsidy from the state. Just as critically, it calls for effective means of recognising, coordinating and funding academic development across the sector. To be more specific, serious crises for both the students and the institutions have emerged from the funding arrangements of the higher education system. Without making adequate provision for academic development, the success rates and output quality would most likely deteriorate. In addition, the student body is increasingly representative of the broad population, and brings into the system the learning deficits accumulated in Black schools (White Paper on Education and Training, 1995:32-33). Higher education institutions are therefore compelled to grapple with the consequences of poor secondary education among an increasingly higher proportion of the students they admit.

Given these challenges and within the broad context of the national higher education system, the *masters degree study programme* is aimed at fostering and developing high level

educationally accountable expertise, knowledge and skills that are necessary to meet the needs and aspirations of society. Today's circumstances call for a better educated and skilled workforce which is considered a prerequisite for enhanced productivity in the domestic economy and competitiveness in international markets, and significant growth in entrepreneurship and small-business development (White Paper on Education and Training, 1995:61). The primary objective of the *masters degree study programme* is to train students to do independent research according to acknowledged research methods. While learning to do research according to acknowledged research methods, masters degree students acquire and develop (to varying degrees) a range of skills of general applicability; i.e. a general development of the mind and of personality (Rudd, 1985:1). The most important of these skills is probably a greater capacity for critical, constructive and independent thought, as well as the ability to scan and digest written material rapidly. In addition, the students gain an intellectual and aesthetic satisfaction from successfully completing the masters degree study programme.

However, many masters degree students are often not completely successful in their studies. Some fail to gain the masters degree, others take inordinately long to do so. This problem could be ascribed to many factors and/or conditions, including the following (Rudd, 1985:41):

- A substantial lack in the knowledge and skills that students had brought from their earlier studies.
- The inability to write (formulate) clearly, concisely and in a well-organized way. The lack of this basic skill which is universally considered necessary for achievement of a higher degree, seems to be the main cause of delay for some students.
- Students' inaccurate self-assessment of their own capabilities and/or their readiness to cope with the demands that stem from the study programme

The masters degree study programme which includes a substantial dissertation, requires that students are able to *inter alia* cope with the following demands:

- Consulting of recent and relevant research literature about the theme in question
- Critical evaluation of the above-mentioned literature and drawing well-founded conclusions on the basis thereof
- Applying previously learned information, rules or theoretical principles in order to deal with specific issues

These demands call for skillful thinking during which a variety of cognitive skills are applied (Van Ende, 1994:66). Contrary to popular belief, skillful thinking is neither an incidental outcome of experience nor an automatic product of study in any particular subject area

(McPeck, 1981:104; Glaser, 1941:69; Taba, 1965:534). It requires deliberate, continuing instruction, guidance and practice in order to develop the proficiency required for success in education and in today's world. Beyer (1987:2) points out that most individuals - especially novices, beginners, and the less able - if left to their own devices *do not seem to develop to the fullest the skills of thinking of which they are capable*. Educators are therefore being challenged to strive for excellence in their students' development in incorporating the higher goals of learning, thinking, and problem-solving skills as well as basic computational and decoding skills.

Against this background, *how then should masters degree students be empowered to pursue and expand educational excellence through the masters degree study programme, whilst at the same time maintaining existing standards to ensure the value and credibility of the attained masters degrees?* Friedman & Jenkins-Friedman (1986:113) point out that fostering educational excellence is a demanding, time-consuming and expensive process. There are probably several ways to deal with this issue. This investigation is focussed on improving the quality of prospective masters degree students' thinking by improving, through instruction, specific skills that are employed when thinking (cognitive skills), as well as other relevant basic skills which are necessary to undertake the masters degree study programme. By means of the research undertaken, clarity will be sought on the readiness of prospective masters degree students; viz. classifying the students on the basis of their cognitive and other relevant basic skills to undertake a masters degree programme. Based on information obtained in this regard, educational practices could be aimed at preparing these students, where necessary, to cope with the demands that stem from the masters degree study programme. Such an approach could lead to expanding academical excellence through the masters degree study programme and to maintaining academic standards to ensure the value and credibility of the masters degrees.

2. STATEMENT OF THE PROBLEM

In concentrating on the readiness of prospective masters degree students in terms of cognitive and other relevant basic skills which are necessary to undertake a masters degree programme, the following questions remain to be answered:

- Which cognitive and other relevant basic skills do prospective masters degree students need to successfully complete the masters degree study programme?

- How could the readiness of students in terms of the necessary cognitive and other basic skills be assessed/measured?
- How could prospective masters degree students be prepared/helped in acquiring and practising the necessary cognitive and other basic skills that will enable them to cope with the demands of the masters degree study program?

Answers to these questions proclaim a need to address the following issues:

- The identification, understanding and description of *cognitive and other relevant basic skills* that prospective masters degree students need in order to successfully complete the masters degree study programme. This should be done with the precision that would make it possible to measure them.
- The development of an *instrument* that could be used to *measure* prospective students' readiness to undertake the masters degree study programme in terms of cognitive and other basic skills. Finding out how people perceive and deal with tasks is, however, not at all easy (Rowe, 1991:9). Frequently, individuals themselves are not aware of these processes. However, even when there is awareness, metacognitive knowledge and a certain amount of executive control on the part of the problem solver or learner, the content of cognitive processes tends not to be readily revealed.
- The design of *bridging courses* that would prepare prospective students for the masters degree study programme; i.e. particularly in terms of acquiring and practising the relevant cognitive skills that will enable them to cope with the demands of the study programme. This implies the identification of ways to help prospective masters degree students learn/develop the necessary cognitive and other relevant basic skills. In addition, bridging courses should focus on understanding, problem solving, comprehending and reasoning on the basis of text material as well as on learning skills. These processes of human cognition and learning should be built into the materials and methodologies that are aimed on preparing prospective students for the masters degree study program. Glaser (1985:ix) states in this regard that educational practices should be aimed at "attacking" the problem of "passive knowledge" - knowledge that students receive and express, but cannot use effectively for thinking and learning.

In summary, the development of higher cognitive skills that enable students to be independent learners and independent, creative, problem-solving users of their knowledge has always been a very important goal for educators. There is evidence, however, that explicit instruction in

these skills is rare and that students' mastery of them is frequently inadequate (Chipman & Segal, 1985:5).

3. RESEARCH OBJECTIVES

In an endeavour to address the afore-mentioned issues pertaining to the readiness of prospective masters degree students, the research undertaken is aimed at:

- identifying *cognitive and other relevant basic skills* that prospective masters degree students need in order to successfully complete the masters degree study programme which includes a substantial dissertation,
- developing an *instrument* that could be used to *determine the readiness* of prospective masters degree students in terms of cognitive and other relevant skills, to undertake a masters degree programme, as well as
- designing *bridging courses* that would prepare prospective students for the masters degree study programme; i.e. particularly in terms of acquiring and practising the relevant cognitive and other skills that will enable them to cope with the demands that stem from the masters degree study programme.

4. RESEARCH DESIGN AND METHODOLOGY

The research is guided by and structured according to the afore-mentioned research objectives, leading to the identification of the following three phases:

- **Phase 1:** In accordance with the first research objective, the first phase of the research project sets out and clarifies the compilation of a theoretical framework on *cognitive and other basic skills* that prospective masters degree students need in order to successfully complete the masters degree study programme. The methods that are used to build this frame of reference include an extended literature study and discussions/interviews with role-players in higher education.
- **Phase 2:** In line with the second objective, this phase of the research comprises the *development and testing* of an *instrument* for the *assessment* of prospective masters degree students' readiness in terms of cognitive and other basic skills, to undertake a masters degree study programme.
- **Phase 3:** In order to fulfil the third research objective, *bridging courses* which would *prepare* prospective students for the masters degree study programme are designed during this phase. These courses would particularly be aimed on

helping students to *acquire and practice* the cognitive and other relevant skills that will enable them to cope with demands made on them during the masters degree study programme.

A review of *phase 1*, which has already been completed and *phase 2*, which is still in progress, is presented subsequently.

5. PHASE 1: A THEORETICAL FRAMEWORK REGARDING COGNITIVE AND OTHER BASIC SKILLS THAT ARE REQUIRED FOR THE MASTERS DEGREE STUDY PROGRAMME

Bearing the research objectives in mind, the issues of definition and description of *thinking*, as well as the *skills pertaining to thinking (cognitive skills)* remain absolutely central. Better understanding of these concepts is therefore firstly needed in order to compile a theoretical framework regarding the cognitive and other basic skills that prospective students need for a masters degree study programme.

5.1 Conceptualization and orientation

Thinking in its broadest sense is the *search for meaning* (Beyer, 1987:16). It consists either of finding meaning assumed to exist already or of making meaning out of something that has no readily apparent meaning. Dewey (In Beyer, 1987:16) describes it as "that operation in which present facts suggest other facts (or truths) in such a way as to induce belief in the latter upon the ground or warrant of the former." Thinking is the mental process by which individuals make sense out of experience. Thinking involves many things and serve many ends. Thinking, which is neither a vague process nor a one-dimensional endeavour, engages a multitude of *mental operations*. Beyer (1987:17) points out that thinking is a complex phenomenon consisting of at least the following *three key components*:

- thinking *activities*,
- certain kinds of *knowledge* and
- certain attitudes or *dispositions*.

Diagram 1 presents a visual representation of these key components. Bearing in mind that this research project is focussed on *how* students think, it seems particularly necessary to provide further clarification on the first key component: *thinking activities*. Thinking involves two general types of operations,

- cognitive operations and
- metacognitive operations.

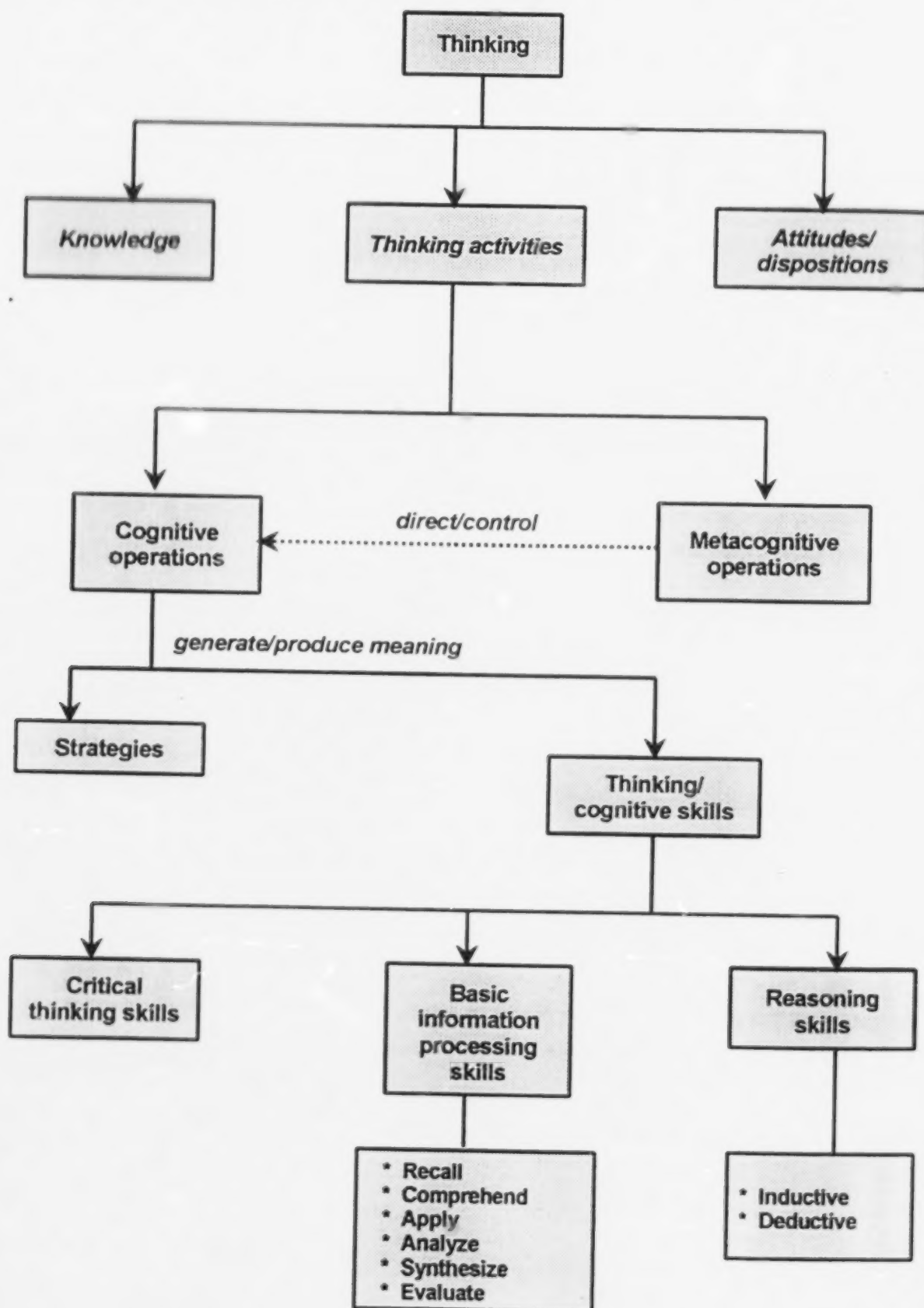
According to Beyer (1987:17) any act of thinking combines operations to produce (generate) meaning (*cognitive operations*) with those that direct/control how that meaning is produced (*metacognitive operations*).

Concerning *cognitive operations*, any individual thinks for the purpose of producing a specific meaning - a solution to a problem, a new truth, a clearer understanding, a judgement, and so on. To produce such meanings, thinking employs both complex general *strategies* and less complex, more subordinate *thinking (cognitive) skills* of which these strategies consist. Beyer (1987:25) points out that *strategies* describe much more complex, sequential operations such as problem solving and decision making whereas *thinking (cognitive skills)* refers to discrete, operations such as the basic information processing skills of analyzing and synthesizing, reasoning skills and more critical thinking skills such as distinguishing what is relevant from what is irrelevant. See diagram 1 in this regard.

The second type of thinking activities, *metacognitive operations*, consists of those operations by which the meaning-making strategies and skills (*cognitive operations*) are *directed and controlled*. Metacognition has often been described as thinking about thinking (Brown, Campione & Day, 1981:14-21; Costa, 1984:57-62). It consists, in part, of those operations involved in directing one's efforts to find or make meaning, especially the major operations of planning, monitoring, and assessing one's thinking.

It should however be borne in mind that the above-mentioned *key components* of thinking - thinking activities, knowledge, and attitudes (dispositions) - are *closely interrelated* (Beyer, 1987:20). Each builds on, and contributes to the others. The more knowledgeable one is about a subject and about various dispositions related to it, the better able one is to use general thinking operations to their maximum effect. What one understands about the nature of knowledge informs and supports attitudes of caution and care in processing information, generating thinking, and accepting as solid or reliable the products of thinking (Beyer, 1987:20). In any thinking act these three components are so intertwined they are often impossible to separate one from the other.

DIAGRAM 1: A conceptualization of thinking



5.2 Cognitive and other basic skills which are required for the masters degree study programme

Which cognitive and other relevant basic skills do prospective masters degree students need to successfully complete the masters degree study programme? The answer is not worded as easily as the problem, as is typical in fields such as education where one deals with human beings with different personalities, different interests, different skill aptitudes, different levels of intelligence, etc. As mentioned in the introduction, the masters degree study programme includes a substantial dissertation which requires students to go beyond memory and use a variety of cognitive and other basic skills; i.e. to engage in constructive and creative thinking. Bearing this in mind, Bloom's taxonomy of educational objectives (1956:62-195) is used to identify, classify and describe the basic information processing skills which are involved in constructive and creative thinking. See table 1 in this regard. This exposition includes other relevant skills which were identified during conversations with role-players in higher education.

6. PHASE 2: THE DEVELOPMENT OF AN INSTRUMENT FOR ASSESSING THE READINESS OF PROSPECTIVE MASTERS DEGREE STUDENTS

It is one thing to identify and describe skills at several cognitive levels; it is quite another "ball game" to measure these skills. The development of an instrument which could be used in assessing prospective masters degree students' command of the different skills (table 1), proclaims the need to take various aspects into consideration. Hunkins (1976:51) points out that the cognitive activities of students are partly determined by the context in which the question is raised as well as the intent of the question. Bearing this in mind, the following steps were deemed necessary before proceeding to construct the instrument for the selection of prospective masters degree students:

- Step 1:** The identification of *key words/phrases* which could prompt students to use the different cognitive skills. See table 2 in this regard.
- Step 2:** The formulation of *examples of questions* at various cognitive levels in an endeavour to set out and clarify the differences between the intent of questions at various cognitive levels. See table 3 in this respect.

TABLE 1 Cognitive and other basic skills which are required for the masters degree study programme

Cognitive skills	
Reproductive (knowledge) skills	These skills enable students to recall or repeat information from memory; viz. to remember the information just as it was learned.
Comprehension skills	These skills enable students to demonstrate that he/she has sufficient understanding to organize and arrange material mentally so that he/she can rephrase it, describe it in his/her own words, and use it for making comparisons. With these skills students: ■ are able to restate information in his/her own way or to select those facts that are pertinent to dealing with specific issues, ■ know what is being communicated & ■ can make use of the material or idea being communicated without necessarily relating it to other material or seeing its fullest implications.
Application skills	These skills enable students to apply (use) previously learned information, rules or theoretical principles in order to deal with specific issues.
Analytical skills	These skills enable students to think critically and in depth, to break information into parts and to offer evidence to support conclusions. With analytical skills students engage in the following three kinds of cognitive processes: ■ They identify the motives, reasons, and/or causes for a specific occurrence ■ They consider and analyze available information in order to reach a conclusion, an inference, or a generalization based on this information ■ They analyze a conclusion, inference, or generalization to find evidence to support or refute it
Synthesis skills	These skills enable students to perform original and creative thinking , viz. to produce an original product or idea of their own. With these skills students are able to make predictions or produce original inputs to solve problems for which a number of answers are possible.
Evaluation skills	These skills enable students to judge the value of the information collected, the merit of an idea or a solution to a problem by using certain criteria . These criteria could be objective standards or a personal set of values.
Other basic skills	
Linguistic (writing) skills	These skills enable students to formulate clearly, concisely and in a well-organized way.
Statistical skills	These skills enable students to demonstrate a knowledge and use of statistical principles in order to analyze and interpret data resulting from the application of statistical techniques.

Step 3: The formulation of *examples of questions* at various cognitive levels in terms of a short text selection with a view to contextualize step 2. The following questions guided the construction of these items:

■ What facts are in the text selection that students could be asked to <i>recall</i> ?	(Knowledge level)
■ What are the main points in the text selection that students will <i>comprehend</i> and be able to <i>rephrase</i> in their own words?	(Comprehension level)
■ What information is there in the text selection that students could apply to solving problems, to classifying, or to giving examples?	(Application level)
■ What questions could be asked about the text selection that require students to consider reasons and motives, to examine the validity of a conclusion, or to seek evidence to support a conclusion?	(Analysis level)
■ Using this text selection as a springboard, how can <i>original student thought</i> - creative problem solving, the making of predictions, and the production of original communication - in writing be stimulated?	(Synthesis level)
■ What issues could be raised from the material in the text selection that will cause students to <i>judge</i> the merit of an idea or the solution to a problem?	(Evaluation level)

The theoretical framework (phase 1 of the research) and the frame of reference which was compiled by means of steps 1-3, was subsequently used to construct the instrument for assessing the readiness of prospective masters degree students in terms of cognitive and other basic skills. The development of this instrument is still in progress and briefly entails the following:

- The selection of appropriate *educational text*
- The formulation of *forty* items on the selected text with a view to measure the various cognitive and other basic skills of the students.

In addition, an instrument is being developed for evaluating the responses of the students.

TABLE 2 Key words/phrases which could prompt students to use the different cognitive skills (Step 1)

Cognitive skills	Key words/phrases which could prompt students to use the different cognitive skills
Reproductive (knowledge) skills	■ define ■ recall ■ recognize ■ who? ■ what? ■ where? ■ when? ■ label ■ repeat ■ list ■ remember ■ identify
Comprehension skills	■ describe ■ compare ■ contrast ■ rephrase ■ put in your own words ■ explain the main idea
Application skills	■ apply ■ classify ■ use ■ choose ■ employ ■ solve ■ write an example ■ how many? ■ which? ■ what is? ■ select ■ demonstrate
Analytical skills	■ analyze ■ detect ■ infer ■ identify motives or causes ■ draw conclusions ■ determine evidence ■ why?
Synthesis skills	■ predict ■ produce ■ construct ■ develop ■ design ■ assemble ■ synthesize ■ propose ■ plan ■ how can we improve? ■ what would happen if? ■ how can we solve
Evaluation skills	■ judge ■ evaluate ■ assess ■ appraise ■ which is better? ■ do you agree ■ decide ■ measure ■ rate ■ would it be better? ■ which is the better option?

TABLE 3 Examples of questions at various cognitive levels (Step 2)

Reproductive (knowledge) skills	Examples of questions aimed at measuring reproductive (knowledge) skills	Intent with questions
Recall knowledge of specific terms	■ <i>What</i> is the meaning of inflation? ■ <i>What</i> is a synapse? ■ <i>What</i> is meant by alpha level in statistics?	These questions are aimed at assessing whether students have knowledge of <i>specific terms/terminology</i> , not whether they can process information.
Recall specific facts	■ <i>When</i> is Columbus Day? ■ <i>What</i> state grows the most lettuce? ■ In plane geometry, the shortest distance between two points is a. a straight line b. a curved line c. an elliptical line d. dependent upon line conditions	These questions are aimed at assessing whether students have knowledge of certain <i>facts</i> . No attempt is made to ascertain if the students know the value of the facts or truly understand the particular facts recalled.
Recall knowledge of conventions in order to deal with specifics	■ How many players do we need for a football team? ■ How do you spell Mississippi? ■ Underline the proper word in the space provided: - My brother and (me, I) went to the fair - My father gave (me, I) a book for Christmas	These questions are aimed at assessing whether students: ■ <i>have knowledge of the relevant conventions</i> in order to deal with specifics ■ know ways one can react to & deal with information & reality. These questions do not require students to initiate any action: students are functioning strictly on the <i>verbal recall level</i>
Recall knowledge of sequences & trends in order to deal with specifics	■ What steps does one follow in directing a bill through Congress? ■ What is the procedure for working through a continuous progress school? ■ List the major steps in making a cake? ■ Indicate four major happenings that have affected our society at large during the last three years	These questions are aimed at assessing whether students: ■ <i>have knowledge of the relevant trends & sequences</i> in order to deal with specific facts ■ could express awareness of happenings and could indicate when they occurred according to a time reference

TABLE 3 Examples of questions at various cognitive levels (Step 2) - continued

Reproductive (knowledge) skills	Examples of questions aimed at measuring reproductive (knowledge) skills	Intent with questions
Recall knowledge of classifications & categories in order to deal with specifics	■ To what classification does the silk moth belong? ■ The discipline which deals with people & their relationship to earth is a. history b. sociology c. geography d. economics e. anthropology ■ The number 4 is a a. cardinal number b. ordinal number c. fractional number d. real number	These questions are aimed at assessing whether students have knowledge of the classifications & categories in question. In order for students to observe various phenomena and to classify them according to some criteria, they must know particular classifications; i.e. recall of knowledge of classifications. Students only have to "know" what the classifications & categories are. They do not have to invent classifications, nor do they have to categorize new data with which they are unfamiliar.
Recall knowledge of criteria in order to deal with specifics	■ How can we tell when we are being effective students? ■ What are three criteria by which we can assess the quality of a television program? ■ According to research principles, a good experiment is a. one which duplicates the practical world b. one which randomizes groups and controls the significant variables c. one which selects groups from the nearest population at hand d. one which extends the experiment over the greatest period of time	These questions are aimed at assessing whether students have knowledge of criteria in question. Students only have to reiterate criteria heard or read. No demand is being made on students to apply the criteria recognized or recalled in any sort of way. NB! Evaluation = the utilization/ application of the criteria in actual problem situations

TABLE 3 Examples of questions at various cognitive levels (Step 2) - continued

Reproductive (knowledge) skills	Examples of questions aimed at measuring reproductive (knowledge) skills	Intent with questions
Recall knowledge of <i>methodology</i> in order to deal with specifics	■ What is one way we can study the intestines of the frog? ■ What are the basic steps in organizing a term paper? ■ List the major steps you would follow in solving a problem in your general mathematics class ■ What procedures can one follow in preparing for a debate?	These questions are aimed at assessing whether students have knowledge of the relevant methodology. Again, these questions do not require that students actually apply some methodology to a particular task or situation.
Recall knowledge of <i>principles, generalizations theories or structures</i> in a field	■ $E=Mc^2$ refers to a. Darwin's theory of evolution b. a theory to explain environmental balance c. Einstein's theory of relativity d. Oppenheimer's theory of atomic power ■ The basic structure of geography centers around the concept of a. man b. region c. globe d. time ■ The concept of interdependence is crucial for understanding nations in today's world. Which of the following generalizations relate to the concept of interdependence? a. The affairs of human societies have historical antecedents and consequences b. No nation or state is an island unto itself c. Areas of the earth develop bonds, interconnections, and relations with other areas d. Economic resources can be used in many ways	These questions are aimed at assessing whether students know and can recall verbally/in writing principles, generalizations, theories & structures. These questions do not require students to discover or apply such information to any situation. One might find that a student could verbalize a principle but upon further questioning not knowing really what it meant or how to apply it.

TABLE 3 Examples of questions at various cognitive levels (Step 2) - continued

Comprehension skills	Examples of questions aimed at measuring comprehension skills	Intent with questions
Translation skills	■ Draw a picture of what you did last summer ■ What does he mean when he says "My kingdom for a horse?" ■ An individual states that he cheats a little on his taxes because everyone does it. This person is a. behaving as a mature adult b. experiencing a delusion c. acting in a childish manner d. rationalizing	These questions are aimed at assessing whether students could translate or paraphrase a communication from one form to another. Questions at this level emphasize putting some communication in another language, into other terms, or reproducing the communication in another form of communication. The student dealing with these questions: ■ must know what the question implies, ■ he/she also must know ways to put particular information into another form. Specifically, the student is asked to commence putting knowledge to work.
Interpretation skills	■ According to the text you read, which option indicates the author's main point about schools in America? ■ What does the chart tell us? ■ Compare the educational ideas of Dewey, Bruner, and Conant with regard to the involvement of students in their learning. ■ Discuss some of the differences between the American way of life and the Canadian way of life. ■ Indicate those situations in which one would use the mean, the mode, and the median in discussing students' learning in the area of mathematics.	These questions are aimed at assessing whether students are able to derive the essential meaning of material being read or situations being encountered. The person is directed to the interrelationships found in the materials presented. These questions do not require the student to discern difficult implications.

◆ These questions could be thought of as asking for "common sense" analysis while analysis questions are more concerned with the rules of logic or the syntactical rules of a particular discipline

TABLE 3 Examples of questions at various cognitive levels (Step 2) - continued

Comprehension skills	♦ Examples of questions aimed at measuring comprehension skills	Intent with questions
Extrapolation skills	■ From studying the corrections on your paper, what would you conclude? ■ What do you think space travel would be like in the next century? ■ Today, we are reading about projections relating to various aspects of life in the future. What are some cautions we need to apply to our reading of these projections? ■ Study the chemical composition of wood and write a list of possible future uses of wood other than for a building.	These questions are aimed at assessing whether students could: ■ formulate an inference or inferences ■ go beyond a recounting of the basic idea of material read or situation encountered ■ read between the lines
Application skills	Examples of questions aimed at measuring application skills	Intent with questions
	■ If Tom Sawyer can paint a fence alone in three days, how long will it take him if he has three friends do it for him, assuming each friend can work at the same speed as Tom? ■ Consider the following trays with bean plants. Some are growing better than others. Study the plants and indicate what you will have to do in order to improve the growth of the poorly developed plants. ■ Mr Jones wishes to purchase a new carpet for his living room. The room measures 18 feet by 20 feet. How many square feet of carpet will Mr Jones need to purchase?	These questions are aimed at assessing whether students could ■ apply successfully some understanding or technique to a problem situation ■ identify the problem and then to recognise some principle/procedure for solution Sometimes these questions only ask for the application of a principle without demanding a complete processing of the data or situation. The emphasis on process & means of discovery certainly requires such skills.

♦ These questions could be thought of as asking for "common sense" analysis while analysis questions are more concerned with the rules of logic or the syntactical rules of a particular discipline

TABLE 3 Examples of questions at various cognitive levels (Step 2) - continued

Analytical skills	Examples of questions aimed at measuring analytical skills	Intent of questions
Analytical skills regarding elements/concepts	■ From our discussion on human behavior, what are two basic assumptions we must accept regarding people? ■ Putting all plants in the sun will make them grow to their maximum height. Is this a fact or an hypothesis? Analyze your materials and experimental results. ■ Job hiring agencies need to make every effort to consider minorities among the applications. When two people are equally qualified for the job, the individual representing the minority should be given the first consideration. This directive, which is part of Affirmative Action, is based on the assumption a. that minorities are more effective workers b. that minorities have been discriminated against in the past c. that minorities have a greater need for employment d. that students need to experience the views of minorities in their educational experience	These questions are aimed at assessing whether students could: ■ diagnose materials, situations or environments and then separate them into their component parts ■ react to unstated assumptions ■ discriminate among the various types of behavior and motives of individuals ■ identify a conclusion from the statements which support it The student is actively engaged with data: these questions demand that he/she processes information. Memory/comprehension is a necessary, but not a sufficient condition for successful dealing with these questions.

TABLE 3 Examples of questions at various cognitive levels (Step 2) - continued

Analytical skills	Examples of questions aimed at measuring analytical skills	Intent of questions
Analytical skills regarding relationships between & among concepts	■ Does the data support the hypothesis that women are not treated equally? ■ Support your conclusion from the information you have processed the amount of differentiation between grades c. An S-U system would give a better picture of how the student is doing d. Grades are determined by chance or probability e. The student is a better judge as the professor of how he/she is doing	These questions are aimed at assessing whether students could discern the relationships present between and among some of the concepts. Questions at this level of analysis aim at engaging students in formal, though logical, reasoning.
Analytical skills regarding organization principles	■ What do you think was the artist's reason for painting this picture? ■ "Some people are more equal than others." Describe the process by which the individual who voiced this phrase arrived at his conclusion. ■ In Leonard Bernstein's Symphony "The Mass" the theme is carried essentially by a. the woodwinds b. the strings c. the brasses d. the percussion e. all of the above	These questions are aimed at assessing whether students could grasp a communication as a whole; i.e. how certain material "hangs" together as a whole; the Gestalt of the situation. The key question is: How do all the concepts and their interrelationships relate to the total situation? These questions should be part of educational dialogue with students creating their own questions.

TABLE 3 Examples of questions at various cognitive levels (Step 2) - continued

Synthesis skills	Examples of questions aimed at measuring synthesis skills	Intent of questions
Synthesis skills to produce a <i>unique communication</i>	■ Write a poem to express your feelings about freedom. ■ Write a defense of the need for wise use of our resources. ■ Write a paper on US population distribution in the next two decades.	These questions are aimed at assessing whether students are able to organize their information to produce <i>a product unique</i> to them. Students should have sufficient time to respond to these questions.
Synthesis skills to produce a <i>plan</i>	■ Indicate a way in which learners can progress through the school system more quickly. ■ Devise a plan by which you can get the community to be conservation conscious. ■ Create a proof for the following equation using what information you have about the binary system of numbers	These questions are aimed at assessing whether students are able to produce/generate a satisfactory solution to the requirements of a particular task.
Synthesis skills to derive a <i>set of abstract relations</i>	■ Drawing on your experiences in school, how do people view education in this country? ■ From the writings on educational theory, what would be the two major ways in which theory can be described?	These questions are aimed at assessing whether students are able to: ■ create/derive some type of statement/conclusion to explain (classify) from data or situations they can analyse ■ formulate generalizations The emphasis is on both inductive and deductive discovery.

TABLE 3 Examples of questions at various cognitive levels (Step 2) - continued

Evaluation skills	Examples of questions aimed at measuring evaluation skills	Intent of questions
Evaluation skills: <i>judgements in terms of internal evidence</i>	■ Which statement below would explain whether the painting is one of high quality? ■ Mr Jones presented his case last night for the increased trade with Communist China. He also indicated that if we trade with China, their economy will become independent in part upon our economy, and this being the case, the tendency for belligerent conflict will be reduced. - Analyze Mr Jones' argument and indicate whether his thinking is on sound or shaky ground. ■ The use of dance for interpretation should not be part of the schools, for dancing is primarily a medium of expression for women in our culture and it should so remain. If we force men into a dance in school situations, we do not create appreciation, but rather destroy the masculine role as defined by the larger society. - Explain the fallacies in reasoning which may exist in the above statement.	These questions are aimed at assessing whether students are able to analyze data or conclusions from standpoints such as: ■ logical accuracy, ■ consistency & ■ other internal criteria The students are dealing with tasks of judging, appraising or valuing. These questions require active student involvement. <i>Students are required to select the appropriate criteria upon which to make evaluative judgements.</i> They are not informed what these criteria are: if they were informed, the students would really only be applying known criteria to a particular situation, and not really be functioning at the evaluative level.
Evaluation skills: <i>judgements in terms of external criteria</i>	■ Indicate in what ways this is a beautiful poem ■ Analyze the transportation network in your community and list all of the aspects you consider to be positive factors. Explain your reasons for the choices. ■ According to the stated situation, which is the most appropriate move the man could take?	These questions are aimed at assessing whether students are able to: ■ apply known criteria to judge situations, conclusions or objectives that he/she has encountered or developed ■ consider if their conclusions, their findings are warranted and worth keeping

7. CONCLUSION

This research project is undertaken in the firm belief that the use of the instrument and the ensuing bridging courses will contribute in expanding educational excellence through the masters degree study programme, whilst at the same time maintaining existing standards to ensure the value and credibility of the attained masters degrees.

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